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Evaluation of Surveillance and Response Systems of Foodborne Diseases and Outbreaks In 2015 At the Ministry of Health Level in Riyadh City, Saudi Arabia

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ABSTRACT

Background: Foodborne disease (FBD) results from ingesting contaminated food. FBDs cause huge burdens on health and economy. Hence, the surveillance and response systems of FBDs and foodborne disease outbreaks (FBDOs) are crucial for disease control and prevention.

Objective: This study aimed to assess the capacity of the surveillance and response systems of FBDs and FBDOs in Riyadh City.
Methodology: A cross-sectional study was conducted at the ministerial level in Riyadh, using the modified World Health Organization model surveillance questionnaire.

Results: A national manual for FBDOs exists, but no priority list at the ministerial level exists. Last year, all monthly reports were received, and all FBDOs were investigated. A written plan for FBDO preparedness and response was also available.

Conclusion: The core functions of the surveillance and response systems for FBDs and FBDOs in Riyadh are not fulfilled. Neither national surveillance manual nor priority list exists for FBDOs in the food safety program. However, the communicable disease directorate has a manual for single FBDs. Feedback and reporting are also impaired in the service level. Overall, the surveillance and response systems of FBDs and FBDOs in Riyadh have huge gaps.

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Introduction

Surveillance is an ongoing, systematic process of collecting, analyzing, interpreting, and disseminating data for action [1]. In particular, foodborne disease (FBD) surveillance has four categories: nonformal system, syndromic surveillance, laboratory-based surveillance, and integrated food chain surveillance (complaint system surveillance) [2].

The World Health Organization (WHO) defines FBD as "a disease of infectious or toxic nature caused by, or thought to be caused by, the consumption of contaminated food or water" [3].

A foodborne disease outbreak is defined as the development of two or more cases of a similar illness caused by eating of the same food (FBDO). For bacterial, chemical, parasitic, and viral agents, laboratory or clinical guidelines for confirming the origin of an FBDO vary. Multiple etiologies refers to an outbreak that has more than one proven etiologic agent (e.g., Salmonella and Staphylococcus). A single food vehicle discovered during the outbreak investigation is designated as a single commodity. Outbreaks attributed to complex food vehicles include are those involving more than one implicated food containing components from several commodities [4].

Food-monitoring programs differ from FBD surveillance programs. The former identifies the problems in food before its consumption and illness occurrence, whereas the latter identifies the problems in food after its consumption and illness occurrence. Foodborne disease surveillance systems attempt to reduce outbreaks of foodborne illnesses. The key components of food safety program capacity are the FBD surveillance and FBDO response systems [5].

In 2006, WHO initiated an endeavor to assess the international burden of FBDs in order to give data and tools to member states to help policymakers and other stakeholders define appropriate, evidence-based food safety priorities at the national level [6].

Through the globalized economy, increasing social and political interdependence, transnational trade, travel, and migration, the risk for cross-border transmission of FBDs increases. As the world becomes more interconnected, FBDs spread more rapidly and effectively. With the globalization of food production, manufacturing, and marketing, the risk for FBD transmission escalates. The emergence of new FBDs, as well as the reemergence of old ones, indicates a crucial transnational policy issue, and national governments need international cooperation to solve these problems [7].

Epidemiological data are needed for various reasons, such as awareness of public health authorities about the nature and magnitude of FBD and their epidemiology, early detection of FBDOs, and planning, implementation, and evaluation of food safety programs. Thus, the epidemiological surveillance of FBDs is fundamental to any food safety program [8].

Outbreak reports are frequently deficient because of late notification, clinical specimen and/or food sample unavailability, unsuitability of laboratories or methods for pathogen detection and identification, insufficient resources and trained staff to conduct investigations, no cooperation between the different disciplines, or failure of investigators to write the final report [9].

FBDs and FBDOs are important public health issues in the Kingdom of Saudi Arabia (KSA). However, people's knowledge on food safety in the food preparation process and the risk factors of food poisoning remains considerably insufficient. Proper training and health education are needed to raise the awareness of food handlers as well as the general population [10].

KSA's Ministry of Health (MOH) developed a manual describing the guidelines for surveillance and preventive measures of communicable diseases. This manual includes FBDs, which are laboratory-confirmed. These FBDs include typhoid and paratyphoid fever (enteric fevers), salmonellosis, shigellosis, amoebiasis, and hepatitis A and E. The infection control or public health personnel should notify the communicable disease coordinator regarding these diseases, especially outbreaks, through laboratory findings. Reporting time of these FBDs is within 48 hours from the service level to the regional level and within 1 month from the regional level to the central (ministerial) level. Communicable disease directorate in MOH shares data with WHO. However, this manual does not mention about food safety program or coordination with it [11,12]. The MOH has the only surveillance system in the country; hence, it may be understaffed for specialists in food safety, if any. Additionally, KSA has shortage of laboratories accredited in dealing with food safety-related analysis and services.

In addition, KSA spends less on food safety research. Consequently, this country has insufficient knowledge and lack of related published data to estimate the burden of all FBDs nationwide. Thus, their data on FBD incidence is underestimated. Medical attention is sought depending on disease severity and the availability of transportation and/or a relative companion. Additionally, FBD cases from private hospitals may go undiagnosed and unreported to the MOH [11].

Thus, this study aimed to assess the capacity of surveillance and response systems of FBDs and FBDOs in Riyadh City at the ministerial level. The specific objectives are as follows: (1) to utilize the WHO-standardized tools for evaluating current FBD and FBDO surveillance and response systems in Riyadh City, (2) to identify weaknesses (absence of core and support functions) in such surveillance and response systems, and (3) to recommend strategies to strengthen the capacity of these surveillance and response systems according to the assessment findings.

Materials & methods

Study Design

This study is cross sectional in design.

Study Setting

The study was conducted in Riyadh City, the capital of KSA with a population of roughly 6 million, at the central (ministerial) level represented by the food safety program of MOH.

Study Population

The study participants were five physicians at the ministerial level. These are all the staff responsible for surveillance in the food safety program.

Sample Calculation

Participants were selected according to the inclusion and exclusion criteria. Considering the small number of available participants, no statistical tests were needed to calculate the sample size (n).

Inclusion Criteria

The investigator interviewed individuals who worked in the food safety program of the MOH for at least 6 months. Language, sex, and nationality were not barriers in this study.

Exclusion Criteria

Individuals with less than 6 months of working experience were excluded because they may not have received a formal training regarding food safety surveillance.

Data Collection

Data were collected using self-administered questionnaires (in English) and observational lists. The principal investigator explained the questions to the participants when needed. These tools are based on the protocol for the Assessment of National Communicable Disease Surveillance and Response Systems, which was developed for the WHO. This protocol is recommended by the WHO to help the national healthcare teams in evaluating their surveillance and response systems for communicable diseases including FBDs [13]. The WHO designed three levels of generic questionnaires: central, district (intermediate), and health facility (service) levels. The questionnaires and observation lists are designed for all communicable diseases. Some elements are not applicable in food safety; one example is the absence of weekly report in food safety. Hence, they were modified according to the local setting in the form of systems used in KSA to be suitable for food safety.

The performance indicators and metrics used in the tools suit the food safety program in KSA. These indicators are selected according to their importance and feasibility of implementation. They include metrics for epidemiology, laboratory, and environmental health. These metrics estimate the performance indicators. For example, if the objective is FBDO detection, one of its performance indicators is the reported cases. Two of the metrics used in this study were completeness (the percentage of cases with complete data) and timeliness (on time reporting). The central, district (intermediate), and health facility levels are labeled as the ministerial, regional, and service levels to assess the food safety program in the ministry (central program), health

directorate in Riyadh, and hospitals, respectively.
Each tool focuses on the program functions: the core and support functions. The core functions of the surveillance systems are case detection, case registration, case confirmation, reporting, data analysis and interpretation, epidemic preparedness, response and control, and feedback. The support functions include the standards and guidelines, training, supervision, communication facilities, resources, monitoring and evaluation, and coordination [14]. The investigators collected the data to ensure reliability and validity.

Analysis Plan
Data were entered and were analyzed using the Epi-Info software (version 3.5.4) from the Centers for Disease Control and Prevention. These data were examined to respond to the objectives of this study. The frequency of various descriptive variables, such as the availability forms, FBD priority list, and standard case definition, were estimated by percentage to know the gaps and opportunities in our surveillance and response systems for FBDs and FBDOs.

The answers could either be "yes" and "no." The "no" answer comprises both "no" and "do not know." In reporting time, "yes" means "immediate," whereas "no" means "do not know" and "24 hours."

The frequencies, chi-square, and p values were calculated for each indicator among the outcomes.

Ethical Concerns
Ethical approval was obtained from the institutional review board of the General Directorate of Research and Study in MOH, while administrative approval was granted by the MOH authorities. Informed consent was clear, indicating the purpose of the study, and was obtained from health authorities and the participants at the ministerial level. No incentives or rewards were given to the participants. Authors declare no conflicts of interest. Participants' anonymity and autonomy were respected. Information was collected for the purpose of improving the surveillance of FBDs through scientific recommendations.

Budget
The authors received no financial support for the research, authorship, and/or publication of this article.

Results
Identifiers
Food safety program in MOH is chaired by a female Saudi physician, who is an epidemiologist graduated from the Field Epidemiology Training Program. This physician is working with four other physicians: 2 Egyptian males, 1 Saudi female, and 1 Egyptian female.

General Indicators
Regarding the availability of legal mechanism to enforce the surveillance of single FBDs and FBDOs, mandatory surveillance and response systems are available for FBDOs, but not for individual FBDs.

Likewise, a national manual of surveillance and response systems is available for FBDOs, but not for single FBDs. The manual for FBDOs was last updated in 2004.

The manual includes *Salmonella*, *Campylobacter*, and enterohemorrhagic *Escherichia coli*, *Listeria*, and *Vibrio cholerae* for the bacterial diseases; norovirus infections and hepatitis A virus for the viral diseases; fishborne trematodes, *Echinococcus* spp., Ascaris, *Cryptosporidium*, *Entamoeba histolytica*, and *Giardia* for the parasitical diseases; and naturally occurring toxins (mycotoxins, marine biotoxins, cyanogenic glycosides, and toxins occurring in poisonous mushrooms), persistent organic pollutants, heavy metals (lead, cadmium, and mercury) for chemical poisoning.

FBDO is defined in the manual as an incident in which two or more individuals experience a similar illness resulting from the ingestion of a common food and in which epidemiological investigation implicates the food as the illness source.

Case Detection and Registration Indicators
Manual and electronic surveillance registers were available for FBDOs, but no priority list nor log book was found. For scattered FBDs, neither priority list, surveillance register, log book, nor database is available (Table 1).

Table 1: Study participants' responses to case detection and registration at the ministerial level. (N = 5)

Indicator: case detection and registration	Response	Frequency	Percentage, %
Presence of priority list for FBDs	No	5	100
Presence of priority list for FBDOs	No	5	100
Presence of surveillance register for FBDs	No	5	100
Presence of surveillance register (manual and electronic) for FBDOs	Yes	5	100
Presence of surveillance log or database register for FBDs	No	5	100
Presence of surveillance log or database for FBDOs	No	5	100

FBD, foodborne disease; FBDO, foodborne disease outbreak

Data Reporting Indicators
The ministerial level is responsible for providing surveillance and investigation forms of FBDOs to the lower levels (regional, sectorial, and service levels). During the last 6 months, no shortage of these forms was reported. In addition, the ministerial level received surveillance reports from the regional level only (not from sectorial or service levels) by any means, either fax, telephone, or email. It received reports about FBDOs, but none about individual FBDs. It also had a 24-hour reporting about FBDO notification and monthly reporting about all FBDOs. The percentage of monthly reports and monthly reports received on time from the region level during the last year was 100% (12 reports out of the "12" expected reports). The MOH does not share the surveillance data of FBDs or FBDOs with the WHO (Table 2)

Table 2: Study participants' responses to data reporting at the ministerial level. (N = 5)

Indicator: data reporting	Response	Frequency	Percentage, %
Is the ministerial level responsible for providing surveillance forms of FBDOs to the lower levels?	Yes	5	100
Were the appropriate surveillance forms deficient at any time during the last 6 months?	No	5	100
Do you receive reports from the regional level?	Yes	5	100
How do you receive reports from the region? (select all possible)	Fax	5	100
	Telephone	5	100
	Email	5	100
What are the events you should receive? (select all possible)	FBDOs only	5	100
Deadlines for reporting to the ministry? (select all possible and specify)	24 hours	5	100
	1 month	5	100
Does the Ministry of Health share surveillance data of FBDs or FBDOs with the WHO?	No	5	100

Number of reports in the last year compared with expected number:
Number of monthly reports received: 12/12
Number of monthly reports received on time: 12/12
FBD, foodborne disease; FBDO, foodborne disease outbreak; WHO, World Health Organization

Data Analysis Indicators

Data analysis was for FBDOs only. Data such as time, place, and person (age and sex), as well as causes, vehicles, contributing factors, and trends of FBDOs, were analyzed.

FBDO Investigation Indicators

A total of 254 FBDOs were reported in the past year. The percentage of investigated FBDOs was 100%. Risk factors were identified in 95%, but the causative agents were confirmed only in 21.7%. All findings (100%) were used for action (Table 3).

Table 3: Study participants' responses to FBDO investigation at the ministerial level. (N = 5)

Indicator: FBDO investigation	
Number of FBDOs in the past year:	254
Percentage of FBDOs that were investigated in the past year:	100%
Percentage of investigated FBDOs with identified risk factors in the past year:	95%
Percentage of investigated FBDOs with confirmed causative agents in the past year:	21.7%
Percentage of investigated FBDOs in which findings were used for action in the past 1 year:	100%

FBDO, foodborne disease outbreak

FBDO Preparedness and Response Indicators

The ministerial level has a written plan for FBDO preparedness and response. Emergency stocks of drugs and supplies were constantly available in the food safety program in the past year. It also has a standard FBDO management protocol but has no budget line or access to funds for FBDO response. In case of an FBDO, an emergency action is executed according to national indicators, such as a high number of patients and deaths and involvement of more than one region (Table 4).

Table 4: Study participants' response to FBDO preparedness and response at the ministerial level. (N = 5)

Indicator: FBDO preparedness and response	Response	Frequency	Percentage, %
Is there a written plan for FBDO preparedness and response?	Yes	5	100
Does the food safety program constantly have emergency stocks of drugs (e.g., antitoxins of Clostridium botulism and hepatitis A vaccines) and supplies in the past year?	Yes	5	100
Is there a standard case management protocol for FBDOs?	Yes	5	100
Is there a budget line or access to funds for FBDO response?	No	5	100
Are there national indicators, such as the number of FBDOs, for an emergency action?	Yes	5	100

FBDO, foodborne disease outbreak

Feedback Indicators

The ministerial level has no editorial board nor an editor at the MOH to publish surveillance information regarding food safety program update. It also has no annual budget for publication. Last year, 20 feedback reports were recorded.

Supervision and Training Indicators

In the past 6 months, the ministerial teams for the food safety program visited the lower levels (regional, sectorial, and service levels). They also had undergone training and, in turn, trained these lower levels regarding the surveillance and response systems of FBDOs.

Resource Indicators

The ministerial level has data management resources such as computer, printer, photocopier, data manager, and statistical package. Communication resources including fax, telephone, and email are also available. However, the program has no vehicle in case of emergency transportation. The number of staff is also insufficient to cover different program duties.

Cooperation and Coordination Indicators

The food safety program is the FBDO surveillance coordination body at the MOH level. However, no computerized surveillance network is currently available. Nevertheless, the head and the staff of the program claimed to be satisfied with the surveillance and response systems of FBDOs. All the five participants gave the same answers for all questions at the ministerial level. Therefore, each question was rated 100%.

Observational List at the Ministerial Level

Some indicators were observed to be present in the ministerial level. This level has a legal mechanism and a national manual that enforce and guide the implementation of the surveillance and response systems of FBDOs. FBDO is also clearly defined. However, no reports to WHO were observed. Moreover, the FBDO data are systematically described by time, place, and person by means of line graphs, maps, and tables. Although the ministerial level has a written plan for FBDO preparedness and response, it has no standard FBDO management protocol. Additionally, it has no stocks of drug, vaccines, and supplies. The updated forms are present. Manual and electronic registers for FBDOs are both available. The ministerial level also received reports of investigated FBDOs from the regional level (Table 5).

Table 5: Observational list at the ministerial level

Indicator:	Response
National surveillance manual for FBDOs	Yes
National surveillance manual for FBDs	No
Register for FBDOs	Yes
Register for FBDs	No
Priority list of FBDs	No
Reports to WHO	No
Description of data by person (age and sex)	Yes
Description of data by place (tables and maps)	Yes
Description of data by time (line graph)	Yes
Reports of investigated FBDO	Yes
Written plan for epidemic preparedness and response	Yes
Adequacy of stocks of drugs, vaccines, and supplies during assessment	No
Surveillance log or database of FBDs	No
Updated forms of FBDO investigation	Yes
Reports from the regional level	Yes

Discussion

With permission from KSA's MOH, the food safety program developed and distributed its own manuals for FBDO investigation.

In this study, all participants employed in the ministerial food safety program gave the same answers for all questions; thus, each question was rated 100%. This absolute concordance may be attributed to different reasons. They may have full information of the program, given that they are working in the same office for a long time.

In the ministerial level food safety program, all our study participants are required to conduct surveillance and response systems for FBDOs, following the guidelines described in the national manual, as observed by the investigators. However, the program does not focus on single FBDs that are linked to communicable disease directorate.

The manuals present in the food safety program are incomplete national manuals, with no priority list. The national manual is similar to that in communicable disease directorate.

Noticeably, two arms are dealing with FBDs: communicable disease directorate, which concentrates on single FBDs, and food safety program, which focuses on FBDOs. This division, which is observed in both ministerial and regional levels, has an impact on the reporting process and biostatistics of single FBDs and FBDOs. It leads to no actual coverage of FBDs and FBDOs and no coordination between two departments as that in developed countries, resulting in underreporting and inaccurate biostatistics. Regarding case detection and registration, surveillance registers for FBDOs can be both manual and electronic. However, the ministerial level has no priority list for organisms causing FBDOs in the food safety program, even those for organisms in the communicable disease directorate [12].

Regarding scattered FBDs, neither a priority list, surveillance register, log book, nor database is available because these FBDs are in the communicable disease directorate. Priority list is necessary when establishing laboratory infrastructures for FBDs. Providing kits for all organism-causing FBDOs is impossible and impractical; thus, the most prevalent organisms should selected and organized in a priority list. By providing a priority list, the number of FBDOs with unknown laboratory results can be reduced [15].

The ministerial level provides FBDO surveillance and investigation forms, which were quite complex to fill, to the lower levels. The forms for single FBDs are provided by the communicable disease directorate. These forms were readily available throughout the last 6 months. Surveillance reports from the regional level can only be sent via fax, telephone, or email. Unfortunately, the ministerial food safety program only receives FBDO reports; individual FBDs are reported to the communicable diseases department. An FBDO should be reported to the ministry within 24 hours, and all FBDOs that occurred in a month should be reported monthly. Last year, the percentage of monthly reports and monthly reports received on time from the regional level was 100%. As mentioned, the MOH does not share the surveillance data of FBDOs with the WHO.

The indicator of data analysis at the ministerial level is for FBDOs only and not for FBDs. In FBDO, the time, place, person (age and sex), causes, vehicles, contributing factors, and trends were analyzed. Therefore, a complete analysis is conducted at the ministerial level, as observed by the investigator. It is an analysis for all regions and not for Riyadh region alone.

Ministerial level analysis relies completely on the reports from the regional level. Hence, if the regional analysis contains flaws, the ministerial analysis will not be completely accurate. All FBDOs reported to the regional level last year were investigated, as confirmed by the ministerial level.

Causative agents were not identified in a very high percentage of investigated FBDOs in the regional and ministerial levels (94% and 78.3%) despite assessing all FBDOs from all regions. This

finding again indicates the importance of laboratory infrastructure and priority list. It is also against the abovementioned information regarding case confirmation in the regional level.

Risk factors were also not identified in a very high percentage of investigated FBDOs in the regional level (94%) despite covering all regions, but a very high percentage was observed in the central level (95%). This finding leaves the effectiveness of environmental investigation questionable. As scientifically known, three types of investigation must be conducted in FBDO: epidemiological, laboratory, and environmental investigations [16].

Indicators of FBDO preparedness and response are complete in the ministerial level. The ministerial food safety program has a written plan for FBDO preparedness and response and available emergency stocks of drugs and supplies.

However, the MOH does not have an editorial board nor an editor to publish surveillance information from the ministerial food safety program and no annual budget for publication, indicating the failure of feedback indicator. Last year, 20 feedback reports were collected, equivalent to the number of health regions in KSA.

The principal investigator noted a confusion between feedbacks and FBDO investigation reports. Feedbacks represent one of the primary components of the surveillance system, that is, dissemination.

Feedbacks are critical for the improvement of practice. They help maintain collaboration among the public health and medical communities, which, in turn, improves reporting to the surveillance system [17]. The ministerial food safety program teams visited the lower levels (regional, sectorial, and service levels) in the past 6 months. They also underwent training, and, in turn, trained the lower levels about the surveillance and response systems of FBDOs.

The ministerial level supervises and trains the regional level in all regions, but the service level is under the responsibility of the regional level. However, the ministerial food safety program does not inform the communicable disease directorate about FBDOs caused by infectious diseases, such as *Salmonella*. In the regional level, the coordinators of communicable diseases and food safety do not know each other's cases despite sitting next to one another. In other words, the communicable disease coordinator is notified about laboratory-confirmed cases (scattered cases) of typhoid and paratyphoid fever (enteric fevers), salmonellosis, shigellosis, amoebiasis, and hepatitis A and E, but he/she does not inform the food safety coordinator about them. These cases may have represented hidden outbreaks that need investigation. According to the regulations, even laboratory-confirmed outbreaks are reported to the communicable disease coordinator [12].

The food safety coordinator does not also inform the communicable disease coordinator about FBDOs caused by organisms that must be reported to the communicable disease directorate.

This dichotomy causes misleading biostatistics of these agents, further resulting in a more serious issue in the ministerial level. Of note, the MOH should communicate with international agencies regarding these cases and the country's situation.

Regarding the resources indicator, both the ministerial and regional levels have good communication and data management. However, their main problem is the shortage of staff to cover program duties. As for the cooperation and coordination indicators, the ministerial level still has no computerized surveillance network. The food safety program is the FBDO surveillance coordination body at the MOH level. Presently, the head and staff of the program are satisfied with the surveillance and response systems of FBDOs.

Syndromic surveillance of FBDs has no role in KSA in any levels, and all formal surveillance systems are applicable in this country.

These results could not reject the study's hypothesis, that is, the surveillance and response systems of FBDs and FBDOs in Riyadh are ineffective, insensitive, inconsistent, and not timely. The core and support functions in the regional and service levels have shown major defects (Tables 33A, 33B, 34, 35).

A standard FBDO management protocol was reported but was not observed by the investigator. A standard FBDO management protocol and unavailability of emergency stocks of drugs are deemed impossible without a priority list. Target organisms of the drugs are also not specified. A protocol may be present but not standard. This protocol shows the steps of FBDO investigation but not cases of treatment.

In addition, the ministerial level has no budget line or access to funds for FBDO response. Dealing with FBDOs without budget is extremely challenging.

In an FBDO, an emergency action is taken according to national indicators, including a high number of patients, deaths, and involvement of more than one region.

Conclusion

The surveillance and response systems of FBDs and FBDOs in the ministerial food safety program work independently without any coordination. The program has no complete national surveillance manual nor priority list for FBDOs, thereby affecting the detection and confirmation of cases. A manual for single FBDs and outbreaks of listed organisms is available in the communicable diseases directorate. Apart from response and control, data analysis and interpretation and epidemic preparedness in Riyadh were acceptable. Registers for FBDOs are available, and communication facilities are outstanding. However, feedback (dissemination) was impaired, underreporting was observed, and budget for FBDO response was unavailable. Therefore, the core functions of the surveillance and response systems of FBDs and FBDOs were not fulfilled. In particular, the support functions were doing less than what is expected in KSA. In conclusion, the surveillance and response systems of FBDs and FBDOs in KSA at the ministerial level still have a huge gap, which must be filled as soon as possible.

Recommendations

1. A national manual for FBDOs must be developed, comprising a clear priority list with case definitions that can improve the laboratory infrastructure.
2. The two arms of FBDs and FBDOs, namely, the communicable disease directorate and food safety program, must be united under one division. If regulations do not allow, the coordination between two divisions must be enhanced first in the regional level then in the ministerial level. Coordination may be achieved through the following points:

a. Assigning one person in the directorate to receive all reports of both FBDs and FBDOs then filtering them and distributing them according to specialty (i.e., FBD to the communicable

diseases coordinator, and FBDOs to the food safety program coordinator).

b. Creating one log book, either manual or electronic (better), in the directorate to receive all reports of either single FBDs or FBDO. Both coordinators must check the log book at least once daily, collect their respective cases, and determine any duplication of reported cases. For instance, if multiple laboratory-confirmed cases of *Salmonella*, which belongs to the list of communicable diseases, were logged, they must be reported to the food safety program coordinator for a possible FBDO. If such cases are confirmed to be an FBDO, the food safety program coordinator must conduct an investigation and collect all confirmed cases, which should then be forwarded to the communicable disease coordinator to obtain a more accurate biostatistics.

c. Reporting confirmed cases of communicable diseases to the communicable disease directorate, with ascertainment to check again if they are already reported from the regional level (communicable disease coordinator). Therefore, more valid biostatistics can be obtained.

3. Intensified training and supervision should be provided.
4. Nationwide research should be continued to further assess these surveillance and response systems.

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